

CLAIMS

What is claimed is:

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1. A method for scheduling transmissions in a network including a plurality of collocated nodes and a plurality of non-collocated nodes, wherein the plurality of collocated nodes communicate between one another over a first interface and the plurality of non-collocated nodes communicate with the plurality of collocated nodes over a second interface, said method comprising the steps of:
- exchanging scheduling information between the plurality of collocated nodes over the first interface, said scheduling information associated with transmissions between the plurality of collocated nodes and each of the plurality of non-collocated nodes on the second interface; and
- determining, based at least in part on said scheduling information, a schedule for the plurality of collocated nodes for transmissions between the plurality of collocated nodes and each of the plurality of non-collocated nodes on the second interface.
2. The method of claim 1, wherein said step of exchanging scheduling information comprises exchanging said scheduling information over said first interface during a time frame while the plurality of non-collocated nodes send data packets to, and receive data packets from, each of the plurality of collocated nodes over the second interface.
3. The method of claim 2, wherein said time frame comprises a first time frame and said step of determining comprises determining a schedule for the plurality of collocated nodes for transmissions between the plurality of collocated nodes and each of the plurality of non-collocated nodes on the second interface, wherein said transmissions occur during a second time frame subsequent to said first time frame.

1 4. The method of claim 1, wherein communications over the second
2 interface are performed using a plurality of time frames, each comprising a
3 control and data portion, wherein said scheduling information comprises first
4 scheduling information, wherein said step of exchanging scheduling
5 information comprising exchanging said first scheduling information over the
6 first interface during said data portion of said time frame, and wherein the
7 method further comprises the step of exchanging second control information
8 between the plurality of non-located nodes and each of the plurality of
9 located nodes over the second interface during said control portion of said
10 time frame, said second scheduling information associated with transmissions
11 between the plurality of located and each of the plurality of non-located
12 nodes.

1 5. The method of claim 1, wherein said step of exchanging scheduling
2 information comprises sending a schedule packet from each of a first at least
3 one located node to each of a second at least one located node of said
4 plurality of located nodes, said schedule packet including an indication of
5 all known nodes in the two-hop neighborhood of each of said first at least one
6 node, incoming and outgoing collision-free links of each of said first at least
7 one node that are already scheduled, time slots and data channels in which
8 new links with each of said first at least one node can be reserved, and time
9 slots and data channels on which each of said first at least one node will be
10 listening while not active in scheduled links.

1 6. The method of claim 1, wherein said step of exchanging scheduling
2 information comprises the steps of:

3 sending a schedule packet from a first at least one located
4 node of said plurality of located nodes to a second at least
5 one located node of said plurality of located nodes over
6 the first interface; and

7 sending, in response to receiving said schedule packet, an
8 acknowledgement packet from said second at least one

9 collocated node to said first at least one collocated node over
10 the first interface.

1 7. The method of claim 6, wherein said step of exchanging scheduling
2 information further comprises the steps of:

3 setting, in said second at least one collocated node of said
4 plurality of collocated nodes, a sequence number of a last
5 received schedule packet to a value of a sequence number of
6 said schedule packet received from said first at least one
7 collocated node of said plurality collocated nodes in said step of
8 sending;

9 sending a hello packet from said first at least one collocated
10 node of said plurality of collocated nodes to said second at least
11 one collocated node of said plurality of collocated nodes, said
12 hello packet identifying said first at least one collocated node
13 and a sequence number of a last sent schedule packet from
14 said first at least one collocated node;

15 determining if said sequence number of a last sent schedule
16 packet indicates that said sequence number of a last sent
17 schedule packet is less than said sequence number for a last
18 received schedule packet;

19 and, in response to a positive determination:

20 transmitting a hello-response from said second at least one
21 collocated node to said first at least one node of said plurality of
22 collocated nodes, said hello-response including said sequence
23 number for a last received schedule packet.

1 8. The method of claim 7, wherein said hello packet comprises a first
2 hello packet and said step of exchanging scheduling information further
3 comprises the steps of:

receiving said hello-response at said first at least one collocated node of said plurality of collocated nodes;

resetting said sequence number of a last sent schedule packet to the larger of said sequence number of a last sent schedule packet or 1 plus said sequence number of a last received schedule packet received in said hello-response; and

sending a second hello packet from said first at least one collocated node said second at least one collocated node of said plurality of collocated nodes, said hello packet identifying said first at least one collocated node and said sequence number of said last sent schedule packet as reset in said step of resetting.

9. The method of claim 6, wherein said step of exchanging scheduling information further comprises the steps of:

setting, in said second at least one collocated node of said plurality of collocated nodes, a sequence number of a last received schedule packet to said value a sequence number of said schedule packet received from said first at least one collocated node of said plurality of collocated nodes in said step of sending;

sending a hello packet from said first at least one collocated node of said plurality of collocated nodes to a second at least one collocated node of said plurality of collocated nodes, said hello packet identifying said first at least one collocated node and a sequence number of a last sent schedule packet from said first at least one collocated node;

determining if said sequence of a last sent schedule packet indicates that said sequence number of a last sent schedule packet is less than said sequence number for a last received schedule packet;

19 and, in response to a negative determination, setting said
20 sequence number of a last received schedule packet to said
21 sequence number of a last sent schedule packet.

1 10. The method of claim 1, wherein said first interface comprises a
2 wired link and said second interface comprises a wireless link.

1 11. The method of claim 1, wherein said wireless link comprises a
2 plurality of RF channels and the plurality of collocated nodes communicates
3 with at least two of the plurality of non-collocated nodes simultaneously over
4 orthogonal channels of said plurality of RF channels.

1 12. A communications network, said network comprising:
2 a plurality of non-collocated nodes, each of said plurality of non-
3 collocated nodes capable of receiving and transmitting
4 transmissions on a first interface; and
5 a plurality of collocated nodes, said plurality of collocated nodes
6 each capable of communicating between one another over a
7 second interface, each of said plurality of collocated nodes
8 further capable of receiving and transmitting transmissions to
9 and from said plurality of non-collocated nodes on said first
10 interface, wherein said plurality of collocated nodes exchanges
11 scheduling information with one another over said second
12 interface, said scheduling information associated with
13 transmissions between the plurality of collocated nodes and
14 each of the plurality of non-collocated nodes on said first
15 interface, and determines, based at least in part on said
16 scheduling information, a schedule for said plurality of collocated
17 nodes for transmission between said plurality of collocated
18 nodes and each of said plurality of non-collocated nodes on said
19 first interface.

1 13. The network of claim 12, wherein said plurality of collocated nodes
2 exchanges said scheduling information over said second interface during a
3 time frame while said plurality of non-collocated nodes send data packets to,
4 and receive data packets from, each of the plurality of collocated nodes over
5 said first interface.

1 14. The network of claim 13, wherein said time frame comprises a first
2 time frame and wherein said schedule determined by said plurality of
3 collocated nodes comprises a schedule for said plurality of collocated nodes
4 for transmissions between said plurality of non-collocated nodes on said first
5 interface, wherein said transmissions occur during a second time frame
6 subsequent to said first time frame.

1 15. The network of claim 12, wherein communications over said first
2 interface are performed using a plurality of time frames, each comprising a
3 control and data portion, wherein said scheduling information comprises first
4 scheduling information, wherein said plurality of collocated nodes exchanges
5 said first scheduling information over said second interface during said data
6 portion of said time frame, and wherein said plurality of collocated nodes
7 further exchanges second control information with each of said plurality of
8 non-collocated nodes over said first interface during said control portion of
9 said time frame, said second scheduling information associated with
10 transmissions between said plurality of collocated nodes and each of said
11 plurality of non-collocated nodes.

1 16. The network of claim 12, wherein said plurality of collocated nodes
2 exchanges scheduling information comprising a schedule packet, said
3 schedule packet including an indication of all known nodes in the two-hop
4 neighborhood of a sending collocated node, incoming and outgoing collision-
5 free links of said sending collocated node that are already scheduled, time
6 slots and data channels in which new links with said sending collocated node
7 can be reserved, and time slots and data channels on which said collocated
8 node will be listening while not active in scheduled links.

1 17. The network of claim 12 wherein said first interface comprises a
2 wireless link and said second interface comprises a wired link.

1 18. An apparatus in a communications network including a plurality of
2 non-collocated routers capable of communicating over a first interface, said
3 apparatus comprising:

4 at least two collocated routers, said at least two collocated
5 routers capable of communications between one another over a
6 second interface, and said at least two collocated routers
7 capable of communications with each of the plurality of non-
8 collocated routers over the first interface, wherein said at least
9 two routers exchange scheduling information over said second
10 interface, said scheduling information associated with
11 transmissions between said at least two collocated routers and
12 the plurality of non-collocated routers on the first interface, and
13 wherein said at least two collocated routers determine, based at
14 least in part on said scheduling information, a schedule for
15 transmission between said at least two collocated routers and
16 each of the plurality of non-collocated routers on the first
17 interface.

1 19. The apparatus of claim 18, wherein the first interface comprises a
2 wireless link and said second interface comprises a wired link.

1 20. The apparatus of claim 19, wherein said at least two collocated
2 routers exchange said scheduling information over said wired link
3 substantially simultaneously with said at least two collocated routers
4 exchanging data with the plurality of non-collocated nodes over said wireless
5 link.

1 21. The apparatus of claim 18, wherein said at least two collocated
2 routers and the plurality of routers and the plurality of non-collocated routers
3 communicating over the first interface using a plurality of time frames, each of
4 said plurality of time frames including a control portion and a data portion, and

5 wherein said at least two collocated routers exchange said scheduling
 6 information over said second interface substantially simultaneously with the
 7 data portion of a selected at least one frame of said plurality of frames
 8 transmit on the first interface.

1 22. The apparatus of claim 21, wherein said selected at least one frame
 2 comprises a first selected at least one frame and wherein said schedule for
 3 transmission between said at least two collocated routers and each of the
 4 plurality of non-collocated routers on the first interface comprises a schedule
 5 for transmission during a second selected at least one frame of said plurality
 6 of frames transmit subsequent to said first selected at least one frame.

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 18